Boron-10 Neutron Detectors for Helium-3 Replacement

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Applications:

- Portal monitoring
- Nuclear energy safety and monitoring
- Nuclear non-proliferation

Benefits:

- Drop-in replacement for Helium-3-based neutron detectors
- Inexpensive, abundant substrate material
- Excellent gamma/neutron discrimination
- Non-toxic, environmentally friendly

Summary:

The United States is running perilously low on Helium-3 gas, a crucial component in today's neutron radiation detectors. Neutron detectors are deployed at ports of entry across the world to monitor people and cargos for smuggled nuclear materials and are often incorporated in nuclear power plant design to monitor power levels and ensure safe operations. With the supply of Helium-3 rapidly dwindling, it is vital to U.S. national security that a viable alternative material be identified, and a new neutron detectordesign made available, especially for portal monitoring applications.

As part of the Laboratory's national security mission, researchers at Los Alamos National Laboratory (LANL) have been working to develop an efficient, cost-effective and environmentally safe alternative to Helium-3 based neutron detectors. Recently, those researchers have developed a Boron-10 based detector that uses finely powdered Boron-10 to achieve thermal neutron detection efficiencies comparable to Helium-3-based detectors, and without the drawbacks of other suggested alternative materials. Unlike Boron Trifloride, a hazardous gas that has been suggested as a Helium-3 replacement, Boron-10 is nontoxic and poses no environmental dangers. Experiments using Boron-10 based detectors also show excellent gamma/neutron discrimination, allowing users to tell the difference between radiation emitted by nuclear materials and naturally occurring gamma radiation emitted by benign cargos, such as bananas.

Finally, the United States has a vast natural supply of elemental Boron, from which Boron-10 can be easily separated, making the material accessible and inexpensive. Using LANL's

proprietary design, Boron-10-based detectors can also be manufactured as direct drop-in replacements to existing Helium-3 detectors, minimizing infrastructure replacement costs.

Development Stage:

A bench-scale prototype has been built and tested with positive results. A field prototype development and test would be required for optimization of the technology.

Technology Readiness Level: 7- System prototype demonstration in an operational environment.

Patent Status:

Neutron Detectors Comprising Boron Powder, US Non-Provisional Patent Application No. 12/797,414 (DOE S-116,324), Patent Application Filing Date: June 9, 2006

Neutron Detectors Comprising Ultra-Thin Boron Powder, US Non-Provisional Patent Application No. 12/963,492 (DOE S-121-225), Patent Application Filing Date: December 8, 2010

Double Helix Boron-10 Powder Neutron Detector, US Non-Provisional Patent Application No. 61/734,343 (DOE S-121-732), Patent Application Filing Date: June 6, 2012

Licensing Status:

Available for exclusive or non-exclusive licensing and collaborative agreements. LANL is currently seeking a commercialization partner to help develop and deploy this critically needed technology both domestically and abroad.

For more information, contact Licensing@lanl.gov.

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